

Claims

- [c1] An apparatus for inserting a data storage device into a carrier, said apparatus including:
 - a conveyor system having a first conveyor with a feed end portion and a discharge end portion and adapted to convey a data storage device carrier in a direction from the feed end portion to the discharge end portion;
 - a first filling station having a device for placing a data storage device adjacent to a said carrier associated with the conveyor; and
 - a guide structure positioned adjacent the conveyor forming a groove for receipt of a portion of a said carrier therein and forming an opening into a lower portion of a recess in a carrier said opening being adapted to allow a portion of a said data storage device to move into a said recess through said opening.
- [c2] An apparatus as set forth in claim 1 wherein the apparatus being operable to position a said carrier at a first angle of at least about 25° from horizontal at the filling station.
- [c3] An apparatus as set forth in claim 1 wherein the apparatus being operable to position a said carrier at a first an-

gle of at least about 35° from horizontal at the filling station.

- [c4] An apparatus as set forth in claim 1 wherein the apparatus being operable to position a said carrier at a first angle in the range of between about 35° and about 60° from horizontal at the filling station.
- [c5] An apparatus as set forth in claims 2, 3, and 4, including a support at the first filling station operable to position a said data storage device at a second angle greater than the first angle by at least about 2° and wherein a lower portion of a said data storage device being closer to its respective carrier than a top portion of a respective said data storage device.
- [c6] An apparatus as set forth in claim 1 wherein the first conveyor including a first conveyor belt adapted to move carriers in a direction from the feed end portion toward the discharge end portion, said first conveyor belt having an exposed first surface portion for engaging said carriers and wherein the conveyor system including a second conveyor belt having a second surface portion facing and spaced from a portion of the first surface portion forming a portion of the guide structure and the groove.
- [c7] An apparatus as set forth in claim 6 wherein the appara-

tus including a power drive associated with the first and second conveyor belts and operable to effect movement of the first and second conveyor belts at the filling station at substantially the same speeds.

- [c8] An apparatus as set forth in claim 7 including a securement station operable to effect engagement between a said data storage device and respective said carrier.
- [c9] An apparatus as set forth in claim 8 wherein the securement station including a grooved roller arrangement rotatably mounted to the apparatus.
- [c10] An apparatus as set forth in claim 2 including a second filling station spaced from the first filling station and adapted to load a data storage device into a second recess of a carrier.
- [c11] An apparatus as set forth in Claim 5 wherein the filling station including an attachment device mounted on a drive and being operable to releasably attach to a said data storage device and remove a said data storage device from a storage magazine and move a removed said data storage device to a release and load position adjacent said groove.
- [c12] An apparatus as set forth in Claim 11 wherein the attachment device including a pair of spaced apart suction

cups connected in flow communication with a vacuum source.

- [c13] An apparatus as set forth in Claim 12 wherein the suction cups are also connected in flow communication with a source of positive pressure fluid wherein the apparatus is operable to apply vacuum to the suction caps and a said data storage device to effect removal of a said data storage device from a storage magazine and to release the vacuum and apply positive pressure air to effect release of an attached said data storage device.
- [c14] An apparatus as set forth in Claims 2 or 13 wherein the apparatus including at least one bottom feed storage magazine adapted for storing a plurality of data storage devices in stacked relationship, the storage magazine including a pair of generally opposed jaws each having a downwardly and inwardly contoured surface with a lower and inward edge portion, the edge portions being spaced from one another through a center point in distance less than a diameter of a portion of a said data storage device to be stored in the storage magazine.
- [c15] An apparatus as set forth in Claim 6 wherein the guide structure including a second conveyor belt spaced from and generally parallel to the first conveyor belt to be positioned on one side of a said carrier and the first con-

veyor belt being positioned on an opposite side of a said carrier.

- [c16] A method of loading a plurality of data storage devices each into a respective recess of a respective carrier, said method including:
 - orienting a carrier at an angle of at least about 25° from horizontal, said carrier having at least one storage recess with a portion exposed to receive a respective data storage device therein;
 - forming a pocket adjacent a lower positioned portion of a said recess;
 - gripping a data storage device in storage;
 - removing a data storage device from storage;
 - positioning a removed data storage device adjacent a respective said pocket; and
 - releasing the grip on the data storage device and allowing said data storage device to move generally downwardly into a respective said pocket and respective said recess.
- [c17] A method as set forth in claim 16 including guiding movement of the data storage device into a respective recess using a sidewall partially defining a respective recess.
- [c18] A method as set forth in claim 17 including releasably

securing a said data storage device in a respective said recess.

- [c19] A method as set forth in claim 17 including positioning a said data storage device at an angle from horizontal greater than the angle of a respective said carrier prior to release from an attachment device releasably retaining the attachment device.
- [c20] A method as set forth in Claim 19 wherein the carrier is oriented at an angle of at least about 35° from horizontal.
- [c21] A method as set forth in Claim 19 wherein the carrier is oriented at an angle in the range of between about 35° and about 60° from horizontal.
- [c22] A method as set forth in Claim 19 wherein said gripping is with a vacuum suction cup.
- [c23] A method as set forth in Claim 22 applying a positive pressure fluid after vacuum is released to effect said releasing.
- [c24] A method as set forth in Claim 18 said releasably securing is effected by moving a through hole past a lock device by applying force to the data storage device on each of opposite sides of the through hole.

